



United States Department of Agriculture - Agricultural Research Service
Food Safety Research Information Office
FSRIO

FOOD SAFETY RESEARCH: A FOCUS ON

Salmonella Vaccine

Reducing the prevalence of *Salmonella enteritidis* infection among flocks through the use of poultry vaccinations is a significant way to control egg-borne human salmonellosis. Scientists at the USDA Agricultural Research Service have developed a poultry vaccine to decrease *S. enteritidis* infection among flocks. The vaccine reduces shedding 10 to 40 percent more effectively than the three commercial vaccines used by the U.S. poultry industry today.

Shedding of *Salmonella* in the feces is the primary method by which *S. enteritidis* infection spreads through a flock. A vaccine that effectively reduces the amount of *S. enteritidis* present in the bird's digestive tract helps eliminate pathogen shedding in the bird's feces. It also assists with eliminating pathogen invasion of the bird's internal organs such as the ovaries where eggs are infected internally.

The vaccine developed by the USDA is an experimental oil emulsion vaccine that differs from commercial preparations because it increases specific levels of antibodies in the digestive tract thereby reducing *Salmonella* in the hen's intestinal tract and preventing infection of eggs and disease transmission.

In the study, the vaccine was administered to the birds subcutaneously in two doses four to six weeks apart before exposing

them to *S. enteritidis*. Strict measures were in place to ensure no other pathogens were present in the hens prior to and during the investigation. A patent for the vaccine has been filed (March 21, 2002, SN 10/101,943), and it is available for licensing.

In the 1970s stringent procedures for cleaning and inspecting eggs were implemented to reduce salmonellosis caused by external fecal contamination of egg shells.

S. enteritidis became a public health concern in the 1980s when it was understood that the pathogen systemically colonizes poultry often implicating the reproductive organs leading to the contamination of eggs.

In the 1990s scientists began developing poultry vaccines

against *S. enteritidis*. Today 25 million doses of *S. enteritidis* vaccine are used annually by the industry.

Unlike egg-borne salmonellosis of the past, the current epidemic is due to intact and disinfected grade A eggs because *S. enteritidis* silently infects the ovaries of hens contaminating the eggs before the shells are formed.



*USDA researchers develop a new poultry vaccine for *Salmonella enteritidis*. The eggs of vaccinated chickens are being collected and labeled.*



*The *Salmonella* family contains over 2,300 serotypes of bacteria.*

RESEARCH AREAS

Understand the molecular ecology of *Salmonella* and develop effective intervention strategies to reduce their transmission in livestock.

Determine the effect of stress on the migration and numbers of *Salmonella* in swine.

Determine if *S. enteritidis* infections are exacerbated in commercial hens that are undergoing molt via feed withdrawal.

Develop a poultry vaccine against *Salmonella enterica* serovar Enteritidis.

Use a novel genetic system to identify *Salmonella* proteins that are essential for growth, virulence or antibiotic resistance.

Develop improved methods for detecting *Salmonella enteritidis* (SE) infections in laying flocks and SE contamination in eggs.

Understand antibiotic resistance and prevent its spread and acquisition by other bacteria and other hosts.

Monitor animal *Salmonella* isolates to determine frequency and trends of resistance determinants in bacterial population studies.

FSRIO DATABASE PROJECTS

Projects in the FSRIO database related to this topic are listed below. Visit FSRIO online to access the projects.

A Salmonella enteritidis Lipopolysaccharide Vaccine for Poultry

USDA - National Research Initiative

Development of Improved Killed Vaccines for Salmonella Enteritidis (coming soon to the FSRIO Database)

USDA - Agricultural Research Service

Effects of a Variety of Stress Factors on Immune System of Poultry and Subsequent Infection of shell Eggs by Salmonella

Joint Institute of Food Safety and Applied Nutrition

Epidemiology And Ecology Of Salmonella Enteritidis In Commercial Poultry Flocks

USDA - Agricultural Research Service

Mechanisms of Salmonella Colonization in Poultry

USDA - Agricultural Research Service

Microbial Pathogenesis and Molecular Epidemiology of Egg-Contaminating SE in Poultry

USDA - Agricultural Research Service

RESOURCES

This factsheet was produced using the resources listed below. Visit FSRIO online to access these links.

Genome Sequencing Center Bacterial Projects

Washington University Medical School, St. Louis

S. Enteritidis Risk Assessment

USDA/FSIS

Salmonella

WHO

Salmonella

FDA/CFSAN

Progress Report on Salmonella Testing of Raw Meat and Poultry Products. 1998 - 2002.

USDA/FSIS

Surveillance for Outbreaks of Salmonella Serotype Enteritidis 1998 - 2002.

CDC/MMWR

The Use of Vaccines for the Control of Salmonella in Poultry. October 2004.

The EFSA Journal. 2004.

A Possible New Vaccine to KO Salmonella in Chicken Eggs. May 2003.

USDA/ARS



This fact sheet is one of several information products developed by the Food Safety Research Information Office (FSRIO) at the USDA's National Agricultural Library (NAL). Fact sheets on specific food safety research topics are available on the FSRIO web site at:

<http://www.nal.usda.gov/fsrio/research/fsheets.htm>

FSRIO is a unique resource for the food safety research community. The program features a web site that serves as a gateway to research information and includes a database of federally-funded research projects. The database is available for researchers, policymakers, consumers and others to learn about research initiatives, and assist the government in assessing food safety research needs and priorities, thereby minimizing duplication of effort. FSRIO also provides a reference service at no charge.

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